19. (Amended) A preform multi-layered moulding material according to claim 18 wherein the fibrous layer is partly compacted into the resin layer.

a2 cont.

20. (Amended) An article of manufacture produced from the moulding material of claim 1.

21. (Amended) An article of manufacture of claim 20 in which the moulding material is formed by being placed in contact with the mould and allowed to cure.

Remarks

This Amendment and the accompanying remarks are submitted with the national phase entry in the United States of the corresponding PCT application. The following remarks are provided primarily based upon the International Preliminary Examination Report issued by the EPO. Consideration of these comments and the Amendment in connection with the examination of the application is respectfully requested. These comments were provided to the EPO on April 9, 2001, and are reproduced here.

Historically, laminate mouldings were formed by the hand lay-up of individual layers of fibrous reinforcement material which were wetted out with a resin after they were laid up in the mould. A problem associated with this particular technique is that it is very laborious and therefore not cost effective. Another very important problem is that the ratio of the reinforcement material and the resin material can not be held constant. This results in products of a variable quality. If insufficient resin is used in the process, this inevitably leads to the inadequate wetting out of the fibrous material, resulting in voids in the cured laminate which impair the structural properties of the product. If too much resin material is used, this results in a product which is overweight and which has undesirable structural properties (pages 1, lines 8 to 11 of the application).

To overcome these problems, preformed, pre-impregnated reinforcement material known as "prepreg" was developed in the early 1.970s. This preform moulding material is supplied to the fabricator in a ready-made format so that the material can be directly applied to the mould. Prepregs are processed by applying heat together with pressure and/or vacuum to cure the resin. The resulting moulded articles from the prepreg material are of a consistent quality since the reinforcement material/resin ratio is optimally defined by the manufacturer of the preform material. An additional advantage of this material is that it allows combined layers of reinforcement fibers and resin material to be laid up at once. (page 1, lines 11 to 30 of the application).

A particular problem associated with these prepreg materials, is that the prepreg material has little or no porosity through its thickness, so that substantial volumes of laminar gases such as air are trapped inside the laminate during processing of the material, which result in voids in the cured laminate. Such voids result in the laminate having poor mechanical properties which can lead to premature failure of the cured composite material structure (page 1, lines 30 to page 2 line 14 of the application).

In the past, one way of partially overcoming the above described problems of laminates formed by prepreg materials, was to locate layers of dry reinforcement fibrous material between layers of prepreg material to allow some of the intra-laminar trapped air to escape via the reinforcement layer during processing of the laminate stack. From the above discussion however it is clear that although these dry reinforcement fibers may aid in venting some of the intra laminar gases, they also impair the quality of the laminate, since they prevent an optimal reinforcement material to resin ratio from being achieved (page 3, lines 1 to 11). Further, the application of dry fibrous reinforcement layers is laborious and therefore less cost effective.

The present invention relates to a pre-form moulding material comprising an air venting structure for allowing entrapped air to be released from the laminate during processing of the moulding material, said moulding material further comprising an amount of resin which is controlled such that when the material is processed, the correct amount of resin flows into

the dry fibrous layers and there is no reduction in the cured resin content (page 4, lines 29 to 31, of the application). No reduction in the cured resin content occurs, because the intra- and inter-laminar gases can pass out of the laminate via the reinforcement layer. Therefore, in contrast to a prepreg material in which this air venting capability is not present, the air can be removed from the moulding material during processing of the material.

AMENDMENT OF CLAIMS AND DESCRIPTION

Claim 1 has now been amended such that the air-transport feature now reads "said fibrous layer allowing entrapped air to pass out of the material during processing of the material".

We have also amended claim 14 and deleted claim 15 as originally filed and we have also deleted the corresponding reference to this claim on page 3, line 26 of the published application.

AIR TRANSPORT PROPERTIES

The description of the present application discloses a moulding material comprising a fibrous layer for allowing entrapped air to pass out of the laminate during processing of the material. Claim 1 is amended to include this feature.

This feature is disclosed on page 4, lines 22 to 24, where it is disclosed that the fibrous layer reduces the problem of void formation (see also page 3, lines 1 to 11 and page 2, lines 10 to 14 of the application) . Further, we refer to page 5, lines 15 to 19 of the description, where it is disclosed that voids are evacuated by the excellent air transport properties of the moulding material and thus resin can fill all voids as no air is trapped.

We submit that the above references in the description are not of a speculative character. Throughout the description of the application, reference is made to the evacuation of air via the fibrous layer.

For example, on page 4, lines 30 to 32 of the application it is disclosed that when the moulding material is cured, the correct amount of resin flows into the dry fibrous layers and thus there is no reduction in the cured resin content. The flow of resin into the dry fibrous layers can only be achieved if air can pass out through the fibrous layer, otherwise the resin would not flow into the fibrous layer. Further, on page 12, lines 31 to 33 of the application, it is disclosed that improved results in processing the material are obtained if care is taken to ensure that the dry fibrous layers are in contact with a vacuum system to ensure that entrapped air can be fully evacuated. On page 15, lines 8 to 15 of the application, the description refers to the evacuation of air from the laminate stack via the fibrous reinforcement layers. Page 12, line 21, also refers to the air breathing capabilities of the present invention. Furthermore, the description discloses a moulding material comprising dry reinforcement layers enabling the moulding material to completely "wet out" and pr6duce a laminate which is free of entrapped air (see page 16, lines 25, 26; page 4, lines 5 and 6; page 11, lines 9 to 15 of the application).

From the description it is therefore (we submit) unambiguously clear that the moulding material comprises a fibrous layer for allowing entrapped air to pass out of the laminate during processing of the material.

FUNCTIONALITY OF THE AIR TRANSPORT FEATURE

We submit that the present claim cannot be defined more precisely and unambiguously without unavoidably restricting the scope of the invention. Therefore this feature cannot (with equity) be defined in any other way than by including a functional feature which relates to the air transport properties of the material.

The feature of the air breathing properties of the moulding material is further sufficiently clearly and unambiguously disclosed for the skilled man to reduce this feature to practice. In this respect we refer to page 11, line 16 to 32 where a method is described for fabricating the moulding material according to an embodiment of the invention. We further refer to page 4, line 5 and 6, and page 10, line 8 to page 11, line 11 of the application.

NOVELTY

We draw the Examiner's attention to two important features which have been introduced into present claim 1: the preform moulding material and the air transport properties of the material.

The preform feature as introduced in the present claim refers to the moulding material being pre-fabricated or pre-formed before the material is transported and supplied to the manufacturer of composite mouldings. This particular feature of the invention is disclosed on page 1, lines 11 to 16; page 1, lines 17 to 21; page 5, lines 3 to 5; page 6, lines 1 to 6; page 5, lines 29 to 31 in which the separate stages of production of the prepreg and processing of the prepreg are described; page 8, lines 5 to 7 wherein it is referred to the pre-fabrication of the moulding material; page 10, line 11 to page 11, line 32 which relates to the production and storage of the preform moulding material, and, finally, page 17 lines 1 to 5 which again refers to the moulding material being supplied to the fabricator in a pre-fabricated form, ready for its application inside the mould.

The expression 'preform' within the context of the present application, relates to the moulding material (and not to the laminate) which is pre-formed or pre-fabricated or pre-manufactured as a material that can be supplied to the fabricator's facilities and can be readily applied to a mould.

Without wishing to repeat our arguments as submitted to the Written Opinion, we refer the Examiner to the discussion of the prior art documents. We believe that documents D3, D5 and D7 relate to a moulding material which is pre-fabricated (a-preform) ; whereas the other documents cited in the search report do not refer to such a material. Documents D2 and D6 relate to the air breathing properties of the laminate structure as described therein. However, these documents do not disclose preform moulding materials. Documents Dl and D4 do not disclose a preform moulding material nor do these document relate to the air breathing properties of the materials.

Therefore, we urge the Examiner to review the position and to accept that the disclosure facts as discussed above establish that amended claim 1 is novel over the cited prior art of documents Dl to D6. Further, claim 1 is inventive over the cited prior art for reasons given in response to the First Written Opinion.

Respectfully submitted,

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By____________________________

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Attachment

VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Amended) A preform multi-layered moulding material comprising a layer of resin material and conjoined to at least one surface thereof a fibrous layer, said [moulding material further comprising an air transport structure for] fibrous layer allowing entrapped air to pass out of the material during processing of the material.

2. (Amended) A preform multi-layered moulding material according to Claim 1 wherein a first fibrous layer is conjoined to the upper surface of the resin layer and a second fibrous layer is conjoined to the lower surface of the resin layer.

3. (Amended) A preform multi-layered moulding material according to Claim 2 wherein the first and second fibrous layers are formed from the same material.

4. (Amended) A preform multi-layered moulding material according to Claim 2 wherein the first and second fibrous layers are formed from different materials.

5. (Amended) A preform multi-layered moulding material according to [any one of Claims 1 to 4] claim 1 wherein the [or each] fibrous layer is held in place by the inherent tack of the surface of the resin layer.

6. (Amended) A preform multi-layered moulding material according to [any one of Claims 1 to 4] claim 1 wherein the [or each] fibrous layer is partially impregnated by resin.

7. (Amended) A preform multi-layer moulding material according to [any one of Claims 1 to 6] claim 1 wherein a tackifier and[/or] a binder [is] are applied to at least one [one or both] outer surface[s] of the at least one fibrous layer.

8. (Amended) A preform multi-layer moulding material according to [any one of Claims 1 to 7] claim 1 wherein the fibrous layer is continuous.

9. (Amended) A preform multi-layered moulding material according to [any one of Claims 1 to 8] claim 1 wherein the fibrous layer is discontinuous.

10. (Amended) A preform multi-layered moulding material according to [any one of Claims 1 to 9] claim 1 wherein the resin system is a thermosetting polymer.

11. (Amended) A preform multi-layered moulding material according to Claim 10 wherein the thermosetting polymer is selected from epoxy, polyester, vinylester, polyimide, cyanate ester, phenolic and bismaleimide systems, modification thereof and blends thereof.

12. (Amended) A preform multi-layered moulding material according to [any one of Claims 1 to 11] claim 1 wherein the [or each] fibrous layer is formed from a member of the group consisting of glass fibers, carbon fibers, polyethylene fibers, aramid fibers, natural fibers [or] and modified natural fibers.

13. (Amended) A preform multi-layered moulding material according to [any one of Claims 1 to 12] claim 1 wherein the fibers in the fibrous layer [or layers] are unidirectional.

14. (Amended) A preform multi-layered moulding material according to [any one of Claims 1 to 13] claim 1 wherein one or more fibrous layers of the material is a prepreg.

Delete Claim 15.

16. (Amended) A preform multi-layered moulding material for use in the production of a surface layer comprising a multi-layered moulding material according to [any one of Claims 1 to 15] claim 1.

17. (Amended) A preform multi-layered moulding material for use in the production of a surface layer according to claim 16 in which a woven fibrous layer is conjoined to one surface and a nonwoven fibrous layer is conjoined to the opposing surface.

18. (Amended) A [method of forming a] preform multi-layered moulding material according to claim 1 wherein the material is formed [of anyone of Claims 1 to 17] by placing the [or each] fibrous layer in contact with the resin layer.

19. (Amended) A [method] preform multi-layered moulding material according to claim 18 additionally comprising the step of partly compacting] wherein the fibrous layer is partly compacted into the resin layer.

20. (Amended) An article of manufacture produced from the moulding material of claim 1 [anyone of Claims 1 to 17 or made in accordance with any one of Claims 18 to 19].

21. (Amended) An [method of forming the] article of manufacture[ing] of claim 20 in which the moulding material is formed by being placed in contact with the mould and allowed to cure.